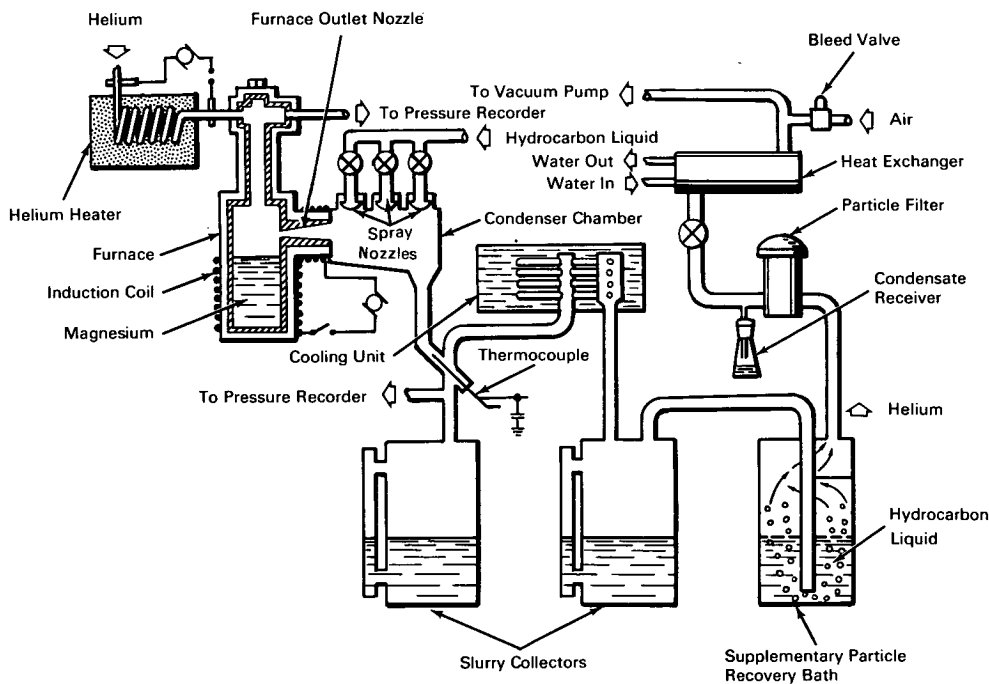


NASA TECH BRIEF



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Vapor Condensation Process Produces Slurry of Magnesium Particles in Liquid Hydrocarbons



The problem:

To design an apparatus for the production of a physically stable, homogeneous slurry consisting of finely divided magnesium and liquid hydrocarbons, to be used as an afterburner or ramjet aircraft fuel. Slurries produced by conventional methods, using a mechanical disintegration process, contain metal particles of low purity, oversize dimensions, and improper shape. Such slurries have nonuniform properties and tend to clog flow lines.

The solution:

An apparatus that produces a slurry by a vapor condensation process involving the vaporization of magnesium and sudden cooling of the resultant vapor with a liquid hydrocarbon spray, which also serves as the dispersing medium for the condensed magnesium particles.

How it's done:

The furnace chamber is first partly filled with bulk magnesium. The system is evacuated and purged with

(continued overleaf)

helium or other inert gas to remove all oxygen, and then pressurized to approximately 3.5 psi with this inert gas. With no flow of materials through the system, electrical power is applied to the induction coils surrounding the furnace and the furnace outlet nozzle. When the temperature of the liquefied magnesium in the furnace reaches approximately 1400° F, flow of magnesium vapor into the condenser chamber is initiated by reducing the pressure downstream from the furnace nozzle with a vacuum pump and starting the flow of helium through the gas heater and furnace. At the same time, the hydrocarbon liquid is sprayed through the three nozzles into the condenser chamber, where rapid condensation of the magnesium vapor and blending of the resultant metal particles with the unvaporized hydrocarbon liquid occurs. The slurry thus formed passes into the first slurry collector, which is positioned below the condenser. Any of the uncondensed hydrocarbon and magnesium vapors as well as the helium gas pass through coils in the cooling unit. The resultant slurry formed in the coils passes into the second slurry collector. As a further precaution in preventing loss of metal particles, the helium is led from the second slurry collector into the bottom of the supplementary particle recovery bath, which is approximately half-filled with hydrocarbon liquid. As the helium bubbles through the bath, any entrained magnesium particles are trapped in the hydrocarbon liquid. The helium then passes through a filter and water-cooled heat exchanger to the vacuum pump line.

The slurry recovered from the two collectors, the hydrocarbon bath, and the condensate receiver is

pumped through a 100-mesh screen (not shown), to remove any coarse particles, and then thoroughly mixed with a turbine stirrer (not shown). The resultant slurry, which contains approximately 0.5% by weight of solids, may be used without further treatment. The mixture may be further concentrated, if desired, using a bowl-type centrifuge. An appropriate surface-active agent must be added to the concentrated mixture to produce a pumpable (low-viscosity) slurry.

Notes:

1. The magnesium particles in the slurry have an average equivalent spherical diameter of less than 2 microns and a purity ranging as high as 98% by weight.
2. This apparatus, with appropriate procedural modifications, can be used for the production of slurries containing various metal particles and liquids.
3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio, 44135
Reference: B66-10104

Patent status:

This is the invention of NASA employees, and U.S. Patent No. 2,934,331 has been granted to them. Inquiries about obtaining license rights for its commercial development should be addressed to the inventors, Messrs. | Thomas J. Walsh, | Walter R. Witzke, | and George M. Prok at Lewis Research Center.

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